

MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE

**Earth Observing System (EOS)
Data and Information System
(EOSDIS)
Backbone Network (EBnet)
Training Plan**

Revision 2

May 1996



National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Training Plan

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Preface

This document is under the configuration management of the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division Configuration Control Board (CCB).

Proposed changes to this document shall be submitted to the Nascom CCB, along with supportive material justifying the proposed change. Changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This document describes the types of skills that will be required of operators who monitor and troubleshoot the EBnet and technicians who troubleshoot and repair components of the EBnet and details a training curriculum which will provide the necessary skill set to enable those individuals to perform their jobs with a high degree of effectiveness.

Keywords: *EOSDIS Backbone Network, EBnet; Training, Network Management, Operations*

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Section 1. Introduction

1.1 Authority and Responsibility

The Mission Operations and Data Systems Directorate (MO&DSD) has the authority to implement Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet). This authority was granted to the MO&DSD by the EOS project, under the Office of Mission to Planet Earth (Code Y). The EBnet project is under the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division of the MO&DSD.

1.2 Purpose

This document describes the skill base that is required of successful EBnet Network Operations Center (NOC) Operators, EBnet technicians and EBnet sustaining engineers and defines a plan for providing the appropriate set of skills to operators and technicians. The objective of the training plan as related to EBnet NOC operators is to define a learning path for EBnet NOC operators to ensure that they are highly functional in the areas necessary to provide rapid and accurate assessment of network problems and either resolve the problems (whenever possible) or initiate the problem resolution phase where the responsibility for the repair resides with another organization.

The objective as related to EBnet technicians is to define a learning path for the technicians responsible for resolving problems and repairing EBnet equipment to ensure that they are highly knowledgeable about the equipment used in EBnet and the procedures for troubleshooting the equipment and the network.

This document will be submitted to the outsource contractor for the EBnet and the EBnet Network Management System (NMS) to illustrate the required skill mix and skill level for effective network operation.

1.3 Scope

This document describes the courses that should be successfully completed by EBnet operators and technicians. Training of sustaining engineers is beyond the scope of this document, as the skills are widely varied and the intent is for sustaining engineers to be established as excellent in their respective disciplines prior to their assignment to the EBnet Project.

1.4 Time Frame

This Training Plan shall be in effect from the date of the last approval signature.

1.5 Standards Precedence

EBnet and the EBnet NOC will be based on Government, commercial and international standards. In case of conflict, the following precedence (in descending order) applies:

- Government standards
- Commercial and/or international standards

1.6 Document Organization

Section 2 contains parent, applicable and reference documents related to this Training Plan.

Section 3 contains a systems overview of EBnet and the EBnet NOC.

Section 4 describes the skills needed for effective monitoring, troubleshooting and repair of EBnet.

Section 5 details a curriculum designed to provide the skills described in Section 4 to EBnet operators and technicians.

Section 2. Related Documentation

2.1 Parent Documents

- [1] *Earth Observing System Detailed Mission Requirements*, Interim Draft Release, July 1995
- [2] *Earth Science Data Information Systems (ESDIS) Project Level 2 Requirements Volume X Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Requirements*, December 1995
- [3] *Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Interface Requirements Document (IRD)*, September 1995

2.2 Applicable Documents

- [4] *Internet Protocol (IP): DARPA Internet Program Protocol Specification*, Request for Comments (RFC) 791, September 1981
- [5] *Internet Control Message Protocol*, RFC 792, September 1981
- [6] *A Simple Network Management Protocol*, RFC 1157, May 1990
- [7] *Management Information Base Network Management of TCP/IP Based Internets: MIB-II*, RFC1158, May 1990
- [8] *Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Operations Concept Document*, Draft, May 1996
- [9] *FY95 Nascom System Development Plan*, 540-030, June 1995

2.3 Reference Documents

- [10] *Communications Requirements for ECS Project*, 220-CD-001-003, GSFC, February 1995
- [11] *NASA Communications (Nascom) Access Protection Policy and Guidelines*, 541-107, Revision 2, GSFC, August 1995
- [12] *MODNET/NOLAN Users Guide*, 541-225, May 1995

Section 3. Systems Overview

3.1 EBnet General System Description

The EBnet provides wide-area communications circuits and facilities between and among various EOS Ground System (EGS) elements to support mission operations and to transport mission data between EOSDIS elements. EBnet is responsible for transporting spacecraft command, control and science data nationwide on a continuous basis, 24 hours per day, 7 days per week. The EBnet capability to transport these diverse types of data is implemented as two distinct subnetworks referred to as “real-time” and “science” networks. The real-time network transports mission critical data related to the health and safety of on-orbit space systems and raw science telemetry as well as pre-launch testing and launch support. This highly redundant network provides an operational availability of 0.9998 with a Mean Time to Restore Service (MTTRS) of 1 minute. The science network transports data collected from spacecraft instruments and various levels of processed science data including expedited data sets, production data sets and rate-buffered science data. The science network provides an operational availability of 0.98 with a MTTRS of 4 hours.

The EBnet is monitored 24 hours per day, 7 days per week from the network management station located in the Network Operations Center (NOC). The required availability for the network management station is .96 with a MTTRS of 4 hours.

3.2 Network Operations Center (NOC) System Overview

The purpose of the EBnet NOC is to provide monitoring, management and data collection function for all components of the EBnet, to provide a proactive approach to operating a network by providing advance warning of potential problems, to provide rapid notification when a problem occurs, to provide an organized approach to managing problem reports from the user community and to provide a highly effective level of service and support to the EBnet customers.

The core monitoring capability for the EBnet NOC will be provided by a set of Sun Sparcstation 20 workstations running a suite of Commercial Off-the-Shelf (COTS) software products. The HPOpenView Simple Network Management Protocol (SNMP)-based Network Node Manager product will provide the capability to monitor operational data and status from network infrastructure equipment (routers, switches, hubs, concentrators, etc.) The Remedy Action Request System will provide a trouble-ticketing capability for management of trouble reports, enforcing the procedures for flow of fault and status data through the organization and enforcing problem escalation rules to ensure meeting the MTTRS requirements. Data collected by HPOpenView and Remedy will be archived to the Statistical Analysis System (SAS) and processed on a routine basis to provide reports on usage, failure and operational trends. These software products are supported by integration with the Sybase Relational Database Management System. Trouble tickets and subsequent status updates will be made available to the EBnet user

community via a World Wide Web server and also by Simple Mail Transfer Protocol (SMTP) based electronic mail to the affected EOSDIS local system management (LSMs).

Section 4. Required Skills and Knowledge

4.1 Understanding the Nascom Environment

The staff must understand the scope and importance of the job and how it fits into the "big picture" organizationally. Each staff member needs to fully comprehend what drives the procedures and policies that they are required to follow (requirements like availability and MTTRS). The staff members need to understand what a network is (conceptually first, and then physically). They need to understand the logical view of the network and how data flows through the network. They need to be cognizant of who the users of the network are, where the users are, and what types of data flow over the network

4.2 General Understanding of Networking

Technically, the staff needs to be aware of what equipment is in the network and what each piece of equipment does. They need to understand Transmission Control Protocol/Internet Protocol (TCP/IP) and IP routing: essentially how the network gets the traffic to its destination. The staff members need to be prepared to respond to the varied types of problems that may occur in the network, where the problems may occur, what the symptoms are and how to perform deductive reasoning. The staff needs to understand the procedures for debugging problems, and the procedures for fixing the problems or referring the problems to the appropriate place.

4.3 Operator-Specific Skills

The operators need to understand the concept of generating trouble tickets (problem reports) and need to be informed about how to effectively use the trouble ticketing system and what its features are. They need to understand the concept of network management, what kinds of objects and events are monitored/measured, and at least conceptually understand how this happens. They need to be familiar with the Network Management System (NMS), what its features and capabilities are and how to utilize those features to maximize the information that the NMS provides for the resolution of problems.

Ideally, operators would be able to do some simple traffic and performance analysis as steps towards debugging some more elusive problems.

4.4 Technician-Specific Skills

Technicians should be familiar with all equipment used in the network, how to troubleshoot the hardware and software, and be capable of isolating component failures and replacing the components per the service level agreements with vendors. It is expected that most technicians will have an electronics background upon commencement of their assignment to EBnet.

4.5 Sustaining Engineering Activities

The sustaining engineering role covers a wide range of activities, and is beyond the scope of any single individual. Among the duties performed by the staff will be all Unix system administration of NOC workstations (routine daily tasks through operating system upgrades, device driver installation and system security assurance); subsequent system design, configuration, integration and enhancement of the COTS products used in the NMS, including HPOpenView, Remedy, SAS and Sybase; design and implementation of new network connectivity; design and maintenance of IP routing architecture; detailed end-to-end performance analysis and troubleshooting of complex networking problems; testing and evaluation of new networking equipment and protocols; router configuration and maintenance, vendor interoperability issues and infusion of new technology into the operational network.

Section 5. Curriculum

5.1 General Approach to Training

The training process should begin with understanding the organization. How quickly an individual can progress through the technical training program will depend on the individual's knowledge base in the networking area. It will not be possible to send an individual to two contiguous months of classes and expect them to return fully trained and highly functional. The information in any particular class can be presented to them but only through usage and time will they truly understand its applicability. In Section 5.2, courses numbered [1], [3], [11], [12], and [13] will be offered immediately, prior to an individual's assignment to EBnet. These skills are necessary to performing the most basic functions in support of EBnet. The on-the-job training (described in Section 5.2 item [2]) will begin at the conclusion of the previously listed set of courses, and be interspersed throughout the offering of the remaining courses in Section 5.2. These remaining courses will be scheduled once per month to allow the individuals time to assimilate the information and have adequate opportunity to use the new skills in the operational environment between course sessions.

Operations staff will also benefit greatly from exposure to more highly technical staff in the project. A mentoring program, pairing an operator with a network engineer, where the operator can assist or perform with coaching more complicated tasks (and receiving explanations during or after the fact) will enhance the operator's overall understanding of networking.

5.2 General Curriculum

[1] In-house seminar describing the environment:

- What Nascom is and does
- Overview of Nascom services and technologies
- Contextual information about legacy services and operations
- What is EOS (Program overview)
- What is EBnet
 - How does EBnet fit into the overall EOS picture
 - How does EBnet fit into the overall Nascom picture
- Describe the network, sites, hardware, requirements, how they are met
- Describe the NOC, hardware, software, products, functionalities, operations concept

- [2] Each individual will spend several weeks working in the operations center receiving on-the-job training, observing and having controlled participation in the events happening, learning the procedures, the type of work, etc. Individuals will learn the role of the Communications Manager (COMMGR) in the legacy environment and how problems are handled (especially the urgency with which the real-time problems must be resolved). The first set of operators will not be able to receive on-the-job training in operation of the EBnet NOC. In the future, after there are regular EBnet operations involving the NOC and the NMS, new operators can spend their time in the EBnet environment as well as experiencing the other areas of Nascom operations.
- [3] "Understanding Networking Fundamentals (Data Communications and LAN/WAN Performance)", American Research Group, 3 days
- [4] "Essentials of Wide Area Networking (How to Internetwork LANs and WANs)", American Research Group, 3 days
- [5] "Internetworking With TCP/IP (How to Install, Maintain and Subnet an Enterprise-wide Network)", American Research Group, 3 days
- [6] "Netbuilder Series Configuration and Bridging", 3Com Course #3CS-013B, 2 days
- [7] "Installation and Maintenance of Cisco Routers", American Research Group, 4 days
- [8] "Introduction to Cisco Router Configuration", American Research Group, 5 days (refined to cover primarily TCP/IP)
- [9] "IP Routing", 3Com Course #3CS-308B, 2 days
- [10] "Cisco Internetwork Troubleshooting", American Research Group, 4 days (refined to cover TCP/IP only, no other protocols)
- [11] "HPOpenView Network Node Manager Fundamentals for Network Operators", HP Course# B3305S, 2 days
- [12] "Remedy User Training", Remedy, 1 day
- [13] In-house demonstration of the customizations of the EBnet schema and a description of the workflow and how the operations concept is implemented by the Remedy design.

5.3 Operators Only

- [1] "Network Management with SNMP (Using MIBs, NMSs, Agents and RMONs)", American Research Group, 3 days
- [2] "HPOpenView Network Node Manager Fundamentals for Network Managers", HP Course# B3304S/B4743S, 5 days (network manager and advanced operators only)
- [3] How to use the EBnet NMS.
- In-house tutorial on the customization and features of the EBnet NMS
 - Generating custom or non-routine reports

5.4 Technicians Only

- [1] "Advanced Cisco Router Configuration", American Research Group, 4 days (refined to cover primarily TCP/IP)
- [2] "Cisco Internetwork Design", American Research Group, 5 days (refined to cover primarily TCP/IP)
- [3] "Cisco IOS Update", American Research Group, 2 days

Abbreviations and Acronyms

CCB	Configuration Control Board
COTS	Commercial Off-The-Shelf
DCN	Document Change Notice
EBnet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EGS	EOS Ground System
EMC	Enterprise Management Concept Team
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
ESDIS	Earth Science Data Information Systems
GSFC	Goddard Space Flight Center
HP	Hewlett Packard
IP	Internet Protocol
IRD	Interface Requirements Document
LAN	Local Area Network
LSM	Local System Management
MIB	Management Information Base
MO&DSD	Mission Operations and Data Systems Directorate
MTTRS	Mean Time to Restore Service
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NMS	Network Management System
NOC	Network Operations Center
RMON	Remote Monitor
RFC	Request For Comments
SAS	Statistical Analysis System

SMTP	Simple Mail Transfer Protocol
SNMP	Simple Network Management Protocol
TCP	Transmission Control Protocol
WAN	Wide Area Network

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